

MEMORANDUM

DATE: December 22, 1999

FROM: EM-50 (Werner; 6-9280; Barainca; 3-7259)

SUBJECT: Science and Technology Needs for Long-term Stewardship

TO: Distribution

We ask your assistance in identifying Science and Technology (S&T) needs for an emerging, critical element to the Environmental Management program: long-term stewardship. The goal of long-term stewardship is to ensure sustainable protection of human health and the environment after cleanup, disposal or stabilization is completed. Attached is a background briefing paper on the relationship of long-term stewardship to S&T (Attachment A). Additional information is available on the DOE web page at <http://www.em.doe/lts>.

The Assistant Secretary for Environmental Management, Carolyn L. Huntoon, has identified long-term stewardship as one of her top six management principles for the Environmental Management (EM) program, and has established the Office of Long-term Stewardship (EM-51) to help manage this initiative. To respond to this senior management direction, we request Field Office staff, Site Technology Coordination Group, and Focus Area staff take several immediate actions.

First, Field Office staff should review the immediate needs list included in the attached *Development and Use of Improved Technologies for More Sustainable Long-term Stewardship* (Attachment A), as well as the draft *Long-term Stewardship Science and Technology Concerns* (Attachment B) and provide specific examples of the types of long-term stewardship S&T needs at their sites. If sites have S&T needs in addition to those discussed in the attached documents, they should forward those directly to Michael Barainca in the Office of Long-term Stewardship. In addition to the more systematic process of developing and deploying, S&T now being developed with the involvement of Field Office staff, (see Attachment A) we are also examining a "lead-labs" structure to help more effectively engage Field Office staff.

In the near term, as part of the next update of the Integrated Planning Budget and Accountability System - Information System (IPABS-IS), we are seeking to include information on the S&T needs related to ensuring cost-effective long-term stewardship. We intend to collect this information using the Technology Management System (TMS) and require your updates to the information in the system as soon as possible. Based on the information collected, the Focus Area staff can better respond to the emerging S&T needs at the sites. When completing the TMS S&T Needs Module please include the terms "long-term stewardship", "long-term surveillance and maintenance" or "long-term resource management," as appropriate, in the title or text of the needs description. This will greatly facilitate data management and analysis at HQ.

Second, Field Office staff should carefully review their S&T needs statements to determine if

long-term stewardship needs have been fully considered. At present, there is relatively little information on long-term stewardship needs beyond 2006. Although the broad policy emphasis of the EM program is to accelerate cleanup, close as many sites, and complete as many projects as possible by 2006, it is quite clear that much work, including long-term stewardship, remains to be done after 2006. In fact, it is for these particularly difficult long-term technical problems that S&T offers the greatest hope for more cost-effective solutions. We suspect that there are some long-term S&T needs that were not addressed in the submittal, but could be added upon further consideration. Now is the time to consider long-term needs.

Third, the Site Technology Working Group (STCG) members should begin working with your counterparts who are participating in the long-term stewardship working group to identify long-term stewardship needs on an ongoing basis. For more information on the working group members for your site(s) please contact Steve Livingstone (202 586-9874) or Greg Sullivan (202 586-0771). These working group members have been serving as a clearinghouse for information for their sites on long-term stewardship, including the Fiscal Year 2000 National Defense Authorization Act Report to Congress on DOE Long-term Stewardship Activities and the Programmatic Environmental Impact Study (PEIS) lawsuit Settlement Study on long-term stewardship.

Fourth, the Focus Area staff, working with the Science program and the crosscuts should be contacting their appropriate sites to discuss S&T needs related to long-term stewardship as part of their review, which will be completed by January 31, 2000. This schedule will allow the Focus Area staff to update and validate the responses in the Project Baseline Summary (PBS) process by March 15, 2000. This should also allow Field Office staff to modify their needs description during this time.

We appreciate your support of this new initiative. Please do not hesitate to call Mr. James Werner (202) 586-9820 <james.werner@em.doe.gov> or Michael Barainca (301)903-7259 <Michael.Barainca@em.doe.gov> if you have any questions about the memo or the details of this process.

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Office of Environmental Management

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Attachment A: *Development and Use of Improved Technologies for More Sustainable Long-term Stewardship*

Attachment B: *Long-Term Stewardship Science and Technology Concerns*

ATTACHMENT A

DEVELOPMENT AND USE OF IMPROVED TECHNOLOGIES FOR MORE SUSTAINABLE LONG-TERM STEWARDSHIP

The goal of the long-term stewardship program is to ensure sustainable protection of human health and the environment after cleanup, disposal or stabilization is completed.

Developing and deploying new science and technology (S&T) is clearly vital to the success of the program for two reasons. First, the current lack of cost-effective cleanup technologies gives rise to need for long-term stewardship (e.g., development and deployment of effective technologies at a lower cost will result in fewer sites that will require long-term stewardship in the future). A reduction in the number of sites requiring long-term stewardship will result in a lesser burden on the program as a whole, thereby increasing the likelihood of a successful program at those sites where long-term stewardship is or will be required.

Second, the current methods of providing long-term stewardship are not sustainable and significant improvement is needed. For example, groundwater monitoring methods are costly and require significant labor (e.g., field technicians visiting monitoring wells, purging the wells, retrieving samples, shipping the samples to analytical laboratories, etc.) This intensive monitoring, sometimes employing thousands of wells, would be prohibitively expensive if sustained over the many years of long-term stewardship. Identifying cost-effective technologies offers the potential of greatly reducing costs and waste while improving confidence in sustainable monitoring.

Office of Long-term Stewardship is responding to the need for improved S&T and will encourage the development and use of improved technologies for more sustainable long-term stewardship. The first step, however, is the preliminary identification of specific S&T needs for the long-term stewardship program. Below are some near-term needs that the Office of Long-term Stewardship will be encouraging Focus Areas and Crosscutting teams to address in their investment portfolios. These immediate needs include:

1. Information about the durability of materials and more durable materials - capping/barrier materials (clay, geotextile, plastic, rock, etc.), waste containers and waste forms.
2. Knowledge of fate and transport mechanisms and predictive capabilities.
3. Cost-effective monitoring and surveillance methods (e.g., micropurge, improved methods of detection, analysis, remote sensing, and data transmission)
4. Information management - methods for identifying, recording, storing, archiving, and accessing relevant and necessary information for future site stewards and land/facility users.

5. Support systems - renewable energy systems (e.g., geothermal heat pumps; photovoltaic systems) that can reduce the costs and improve the long-term affordability of pump-and-treat and monitoring systems.
6. Systems engineering and design to ensure that, before new facilities are built and operated, the requirements for decontamination and decommissioning and waste disposition are considered carefully. For example, certain questions should be answered up front, before new facilities are built and operated:
 - How will the facility be decontaminated and dismantled (specific technical plan reflected in the initial construction plan)?
 - How will the various waste streams be managed after the facility is operating and when it has finished operating?
 - Can the facility be reused for other mission requirements if designed appropriately?

The Office of Long-term Stewardship is developing a process for ongoing identification of S&T needs for more cost-effective long-term stewardship. This process will be developed over the next several months, and will build on existing mechanisms within OST and use a variety of other mechanisms. For example, the Office of Long-term Stewardship will be involved in ongoing review of commercial off-the-shelf technology to determine if new methods, science, and technologies are available that might reduce the cost and improve the reliability and affordability of long-term stewardship. In addition, needs identification by site/Project Baseline Summary managers--who are often only focused on cleanup project schedules, waste disposal, and stabilization requirements rather than post-cleanup/disposal/stabilization requirements--might be supplemented by S&T needs identification by land use, development, and land management professionals.

ATTACHMENT B Draft
Long-Term Stewardship Science and Technology Concerns

Attributes Problem Areas	End State	Stewardship Schedules	Technology Issues	Science Concerns
Buried Wastes	Engineered Structures, (Caps, Covers, and Barriers)	Many sites already in stewardship; and remainder will be in stewardship by 2050	-Long term caps and covers -Performance of engineered barriers, liners, etc -Monitoring and Sensors to detect degradation of engineered materials and migration of contaminants	-Chemical and Biological stabilization -Performance Assessment -Material Performance Enhancement -ES&H Monitoring (Biomarkers)
Plumes and Ground Water	Permeable and Reactive Barriers, Bio-remediation, Chemical Stabilization	Some sites already in stewardship remainder by 2050	-Performance of engineered barriers -Monitoring and Sensors to detect migration of contaminants	-Chemical and Biological stabilization -Performance Assessment -Material Performance Enhancement -ES&H Monitoring (Biomarkers)
Above-Ground Structures	Engineered Structure (Tumulus, entombed canyons, reactors)	Some sites already in stewardship remainder by 2050	-Structural integrity of engineered facilities -Monitoring and Sensors to detect material degradation and migration of contaminants	-Chemical and Biological stabilization -Performance Assessment -Material Performance Enhancement -ES&H Monitoring (Biomarkers)
Spent Reactor Fuel	Disposal at High-Level Waste Repository	Yucca Mountain expect to start operating 2010-2033; retrievable monitoring 50-300 years; then long-term monitoring	Office of Civilian Radioactive Waste Management (OCRWM) primarily responsible for stewardship	OCRWM primarily responsible for stewardship

High-Level Radioactive Material (e.g., Cs and Sr capsules)	Disposal at High-Level Waste Repository	Yucca Mountain expect to operate 2010-2033; retrievable monitoring for 50-300 years, then long-term monitoring	OCRWM primarily responsible for stewardship	OCRWM primarily responsible for stewardship
High-Level Waste Tanks	Stabilization and Isolation	High hazard HLW in tanks will be vitrified however the end state for HLW still to be determined	<ul style="list-style-type: none"> -Closure of tanks -Structural integrity of tanks -Barriers and engineered alternatives -Monitoring and Sensors to detect degradation of waste forms and engineered materials and migration of contaminants 	<ul style="list-style-type: none"> -Chemical and Biological Stabilization -Performance Assessment -Material Performance Enhancement -ES&H Monitoring (Biomarkers)
Transuranic Wastes	Disposal at WIPP	After Closure of WIPP in 2034 stability monitoring for 100 years	-Monitoring and Sensors to detect degradation of waste forms and engineered materials and migration of contaminants	<ul style="list-style-type: none"> -Chemical and Biological Stabilization -Performance Assessment -Material Performance Enhancement -ES&H Monitoring (Biomarkers)
Nuclear Materials	Disposal or Storage of Spent Fuel/HLW in repository and TRU Waste in WIPP. Also low level waste facilities will be used for LLW waste as appropriate	To be determined (TBD)	Near term issues are stabilizing and isolating waste for eventual disposal. Nuclear materials will likely be incorporated in fuel elements and burned in reactors or disposed of in HLW waste logs.	<ul style="list-style-type: none"> -Criticality -Safeguards -Verification